

Assessment of Medical Waste Management in Teaching Hospitals in Mosul City: A Descriptive Study

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ABSTRACT

Background and aim: Medical waste management is of great importance due to its infectious and hazardous nature that can cause undesirable effects on humans and the environment. The objective of this study was to identify segregation, storage, transportation, treatment and disposal practices in teaching hospitals in Mosul City.

Material and method: A descriptive study is designed to assess medical waste management in Mosul Teaching Hospitals started from December 2012 to March 2013. The target population (health personnel) of study is approximately (448) participants served in mentioned hospitals were asked to answer study questionnaire. Statistical processing was conducted by the use of SPSS version 17 and Minitab. Chi-square test was used as the test of significance to determine the presence of association between variables; $P < 0.05$ was considered significant.

Results: The results indicated that 79.2% of the respondents indicated that each type of waste clearly identified by a coloured code or symbol. The results also showed that 75.1% of the respondents stated that the waste is stored collected regularly. The most significant result with respect to whether the means of conveyance and transport are cleaned regularly was 40% of the respondents stated that they have no idea about that. The results also showed that 53.8% of the respondents stated that there is no other options rather than incineration have been examined for final disposal of medical waste.

Conclusion: The study concludes that the segregation of medical waste is done regularly and effectively, i.e. each type of medical waste is identified by a coloured code, and there are containers and bags everywhere waste is generated. Concerning to medical waste transport the means of conveyance and transport are available but there is lack of maintenance of these means or replacing them with new ones.

Keywords: medical waste management, segregation, collection, transport, final disposal.

INTRODUCTION

In developed countries, legislation and good practice guidelines define medical wastes and state the various possible ways for collection, transport, storage and disposal of such wastes. In addition, the best available technologies are used for the development of alternatives for proper disposal of medical wastes with minimal risks to human health and the environment (Tudor *et al.*, 2005). Generally there is no single disposal practice as a solution of the problems of managing hospital waste, so in most cases, a number of practices include landfills, incineration, autoclaving, and recycling are used in combination. Each practice has its own weaknesses and strengths (Nemathaga *et al.*, 2008). Health-care waste consists primarily of pathological, infectious, chemical,

pharmaceutical, and domestic wastes as well as sharps that have been contaminated with blood, infectious agents, tissues, organs, etc (Alagoz and Kocasoy, 2008). The hospital waste, in addition to the risk for patients and personnel who handle these wastes possess a threat to public health and environment. Handling, segregation, mutilation, disinfection, storage, transportation and final disposal are vital steps for safe and scientific management of medical waste in any establishment. The key of minimization and effective management of medical waste is segregation (separation) and identification of the waste. The most appropriate way of identifying the categories of medical waste is by sorting the waste into color coded plastic bags or containers (Rao *et al.*, 2004).

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The waste generated from hospitals is now recognized as a significant problem that may have bad and dangerous effects either on the environment or on human beings through direct or indirect contact. Some of the health impacts are results from exposure to hazardous hospital wastes include mutagenic, tetragenogenic and carcinogenic effects, respiratory damage, central nervous system effects, reproductive system damage and others (Felicia *et al.*, 2008). The roles of nursing staff in the process of MWM are the identification and segregation of waste according to classification at the point of generation, supervision and monitoring of the activities of ward reception and cleaner in relation to waste management, and conduction of health education session for the patient and attendant on medical waste management (Musa and Rahman, 2012). Health care waste management (HCWM) is a process aims to help ensuring proper hospital and health-care facilities, hygiene and safety of health care workers and communities in dealing with medical waste. It includes planning and procurement, construction, staff training and behavior, proper use of equipment, proper treatment and disposal methods of medical waste inside and outside the healthcare establishment and evaluation for the process of health care waste management. The present study aimed at to identify segregation, storage, transportation, treatment and disposal practices in teaching hospitals in Mosul City.

RESULTS

Table (1): Health personnel knowledge about medical waste segregation (No. 448)

Index	Segregation	Yes		No		Don't know	
		F	%	F	%	F	%
1	Is each type of waste clearly identified by a coloured code or symbol?	362	79.2	41	9.0	45	9.8
2	Are there containers and bags everywhere where waste is generated?	371	81.2	30	6.6	47	10.3
3	Is sorting carried out effectively from waste production to storage?	235	51.4	77	16.8	136	29.8
4	Are all members of staff reminded about sorting waste?	337	73.7	41	9.0	70	15.3

$\chi^2 = 135.487$; d.f. = 6; P-Value = 0.00

Table (2): Health personnel knowledge about medical waste collection and storage (No. 448)

Index	collection and storage	Yes		No		Do not know	
		F	%	F	%	F	%
1	Is the waste collected regularly?	343	75.1	37	8.1	68	14.9
2	Is the storage time for of collected bags is according to the time identified in the medical waste plan?	278	60.8	48	10.5	122	26.7
3	Does the storage section of medical waste outside the hospital is protected from others but staff?	251	54.9	112	24.5	85	18.6

$\chi^2 = 81.980$; d.f. = 4; P-Value = 0.00

MATERIAL AND METHODS

A descriptive study designed to assess medical waste management in Mosul Teaching Hospitals started from December 2012 to March 2013. The study was conducted in five teaching hospitals (Al Jumhory , Ibn Sina, AL Salam, Ibn AL-Atheer and AL-Khansaa) located in Mosul city. A structured questionnaire consists from three parts was used to collect data. Part one was contained on demographic data sheet of the study sample in hospital. The second part is divided into two main sections which is

the concepts of medical waste and the policy of medical waste management. While the third part had a practical questionnaire interview. The target population (health personnel) of study was approximately (448) participants served in mentioned hospitals were asked to answer study questionnaire. They were chosen purposively from the hospitals concerned with the study. They were related to medical waste management. A total of (40) administers, (96) physicians, (167) nurses, (102) laboratory staff, and (43) service workers were participated. Data were prepared, organized and entered into a computer file; Different statistical methods were used to analyze the data in this study. Statistical processing was conducted by the use of SPSS version 17 and Minitab. Chi-square test was used as the test of significance to determine the presence of association between variables; $P < 0.05$ was considered significant.

Table (3): Health personnel knowledge about medical waste transport (No. 448)

Index	Transport	Yes		No		Don't know	
		F	%	F	%	F	%
1	Are there means of conveyance and transport reserved for medical waste?	340	74.4	45	9.8	63	13.8
2	Do the means of transport meet the requirements (easy to load and unload, no sharp corners, easy to clean)?	228	49.9	102	22.3	118	25.8
3	Do the off-site transport vehicles meet the requirements (closed, load secured, marked with signs)	179	39.2	158	34.6	111	24.3
4	Are the means of conveyance and transport cleaned regularly?	179	39.2	86	18.8	183	40.0

$\chi^2 = 203.363$; d.f. = 6; P-Value = 0.00

Table (4): Health personnel knowledge about medical waste treatment and final disposal (No. 448)

Index	treatment and final disposal	Yes		No		Don't know	
		F	%	F	%	F	%
1	Have the treatment methods been assessed in terms of environmental protection and health protection?	261	57.1	83	18.2	104	22.8
2	Has the impact of the waste on the environment and on staff health been reduced to a minimum?	277	60.6	83	18.2	88	19.3
3	Have options other than incineration been examined?	91	19.9	246	53.8	111	24.3
5	Is particular attention paid to the treatment of sharps and highly infectious wastes (lab cultures, wastes from care of infectious patients)?	300	65.6	60	13.1	88	19.3

$\chi^2 = 310.110$; d.f.= 6; P-Value = 0.00

DISCUSSION

Table 1 relates to separate of waste indicates that 79.2% of the respondents indicated that each type of waste clearly identified by a coloured code or symbol; 9.0 % answered that each type of waste is not clearly identified by a coloured code or symbol; While 9.8% stated that they have no idea about this process. This confirms an important fact that is in sometimes each type of waste is not clearly identified by a coloured code or symbol.

With respect to is sorting carried out effectively from waste production to storage 29.8% of the respondents indicated that they have no idea about how the process is done; 51.4% stated that sorting carried out effectively from waste production to storage; while 16.8 % indicated that the process of segregation is not done effectively. This indicates informing the whole medical staff about the medical waste management plan applied in the hospitals.

Bendjoudi and colleagues stated that the mass fraction of health care waste HCW considered hazardous (pathological, infectious,

chemical, pharmaceutical) is 10–25%, representing a potential threat to health care workers, patients, the environment, and even the general population, if not treated and/or disposed of appropriately; 75–90% by mass of HCW is classified as household waste (cleaning tissues, plastics, papers) that possess no additional risk to health or the environment (Bendjoudi *et al.*, 2009).

In the West Bank, the survey results showed that there is no segregation of waste except for sharps. Two thirds of HCFs have acceptable sharp boxes (sometimes plastic bottles). Less than fifty percent segregate other types of waste like waste generated in operating theatres and labs which includes infectious and pathological waste. Only 7.6% of the facilities use color coding (they use red or yellow bags for infectious waste). One third of HCFs lacks proper onsite storage containers. It is very common that all healthcare waste is mixed with the general waste in open baskets that are lined with very thin plastic bags. The bags are not strong enough and in many cases can be easily punctured allowing leakage and spillage to occur. Labeling

of containers is not used and there is no way to distinguish between waste coming from the kitchens or that from the laboratories (Environmental Quality Authority, 2005).

Table 2 relates to medical waste collection and storage indicates that 75.1% of the respondents stated that the waste is collected regularly; 8.1 % answered that the waste is not collected regularly; While 14.9% stated that they have no idea about the regularity of this process. This confirms an important fact, that the waste is collected regularly in the hospitals concerned with the study.

With respect to whether the storage time for collected bags is according to the time identified in the medical waste plan, the most significant result was that 26.7% of the respondents indicated that they have no idea about the storage time; 60.8.9% stated positively about that; while 10.5 % stated that the storage time of collected bags is according to the time identified in the medical waste plan This indicates that some of hospitals staff have no idea about medical waste management plan items.

With respect to whether the storage section of medical waste outside the hospital is protected from others but staff, 24.5% of the respondents indicated that there is no protection for the storage section of medical waste outside the hospital ; 54.9% stated positively about that; while 18.6 % indicated that they do not know anything about that. This indicates the need of more protection on the storages of medical waste outside the hospitals.

According to the World Health Organization regulations, the storage of waste within the hospital should not exceed 72 hours in winter, 48 hours and summer (in cold areas). However, in the hot areas, storage should not exceed 48 hours in winter and 24 summer hours (WHO, 2005).

Table 3 relates to medical waste transport indicates that 74.4% of the respondents stated that there are means of conveyance and transport reserved for medical waste; 9.8 % denied that; While 13.8% stated that they have no idea about that.

With respect to whether the means of transport meet the requirements (easy to load and unload, no sharp corners, easy to clean) 49.9% of the respondents stated positively about that; 22.3 % denied that ; While 25.8% stated that they have no idea about that. This indicated that the means of transport need to be changed every some years.

With respect to whether the means of conveyance and transport cleaned regularly 39.2% of the respondents stated positively about that; 18.8 % denied that; While the most significant result was that 40% stated that they have no idea about that. This indicated that many of responsible staff neglects monitoring the process of cleaning the means of transport.

The transfer of health-care waste sites must be within the hospital by wheeled vehicles or by other vehicles or containers fitted with hand wheels that are not used for any other purpose. The transfer mean must meet the following standards:

1. Easy loading and unloading.
2. The absence of sharp edges that can cause severe damage to the waste bags or containers during loading and unloading.
3. Easy cleaning and must be clean and sterilized every day using the appropriate purgatory. All bags must be closed tightly and must be sound at the end of transport operations (Environmental Quality Authority, 2005).

Table 4 relates to medical waste treatment and final disposal indicates that 57.1% of the respondents stated that the treatment methods have been assessed in terms of environmental protection and health protection; 18.2 % denied that; While 22.8% stated that they have no idea about that.

With respect to whether other options rather than incineration have been examined, 19.9% of the respondents stated positively about that; 25.8% stated that they have no idea about that; While the most significant result was that 53.8% the respondents stated that there is no other options rather than incineration have been examined. This indicated that other means of treatment and final disposal are not widely used.

With respect to whether particular attention is paid to the treatment of sharps and highly infectious wastes (lab cultures, wastes from care of infectious patients), 65.6% of the respondents stated positively about that ; 13.1 % denied that ; While 22.8% stated that they have no idea about that.. This indicated that the responsible staff is aware of the danger of highly infectious wastes.

Lee and others conducted a study in 2004 showed that 49–60% of medical waste is treated by various incinerations, 20–37% by autoclave sterilization, and 4–5% by other methods. Incineration and steam autoclave sterilization are the main methods currently being used and are considered mature technologies (Lee *et al.*, 2004).

CONCLUSIONS

The study concludes the following: the segregation of medical waste is done regularly and effectively, i.e. each type of medical waste is identified by a coloured code, and there are containers and bags everywhere waste is generated. With regard to medical waste collection and storage the study found out that this process is done regularly yet there is some lack of care about the time identified in the medical waste plan, and weak protection for the storage section of medical waste outside the hospital. Concerning to medical waste transport the means of conveyance and transport are available but there is lack of maintenance of these means or replacing them with new ones. Moreover, many of responsible staff neglects monitoring the process of cleaning the means of transport. Concerning to medical waste treatment and final disposal the study found out incineration is the most used means of waste disposal in the hospitals concerned with this study. A significant proportion of medical waste management staff lacks the information of medical waste plan.

RECOMMENDATIONS

Depending on the results of this study, the following recommendations are set: All staff members concerned with medical waste management should be informed about all items of the medical waste management plan. There is need for sustained cooperation among all key actors (government, hospitals and waste managers) in implementing a safe and reliable medical waste management strategy, not only in legislation and policy formation but also particularly in its monitoring and enforcement. Economically and environmentally sustainable technological options for waste treatment, which can be well operated and maintained, should be considered for medical waste management. Concerning to means of medical waste treatment and final disposal options rather than incineration are recommended to be used in the hospitals concerned with this study. There should be protected hazardous waste landfills specially designed for the final disposal of treated hazardous healthcare waste. Finally the study recommends to enforce the role of the occupational safety unit by doing regular tests for

medical staff , vaccination , providing personal protective equipments and taking care of injured persons during the process of medical waste management.

REFERENCES

- Alagoz, A.Z., and Kocasoy, G. (2008). Improvement and modification of the routing system for the health-care waste collection and transportation in Istanbul. *Waste Management*. 28. p 1461–1471.
- Bendjoudi, Z., Taleb, F., Abdelmalek, F., and Addou, A.(2009). Healthcare waste management in Algeria and Mostaganem department. *Waste Manage*. 29. p 1383–1387.
- Environmental Quality Authority. (2005). *Master Plan for healthcare waste management West Bank/Gaza Strip*. Palestinian Authority.
- Felicia, N., Sally, M., and Luke, C.(2008). Hospital solid waste management practices in Limpopo Province. *Waste Management*. 28. p 1236– 1245.
- Lee, B., Ellenbeckerb, M.J., and Moure-Erasob, R. (2004). Analysis of the recycling potential of medical plastic. *Waste Management*. 22. p 461-470.
- Musa, S., and Rahman S.(2012). *Medical Waste Management*. Training Manual. Directorate General of Health Services. Mohakhali, Dhaka, Bangladesh. p 87-90.
- Nemathaga, F., Maringa, S., and Chimuka, L. (2008). Hospital solid waste management practices in Limpopo Province, South Africa: a case study of two hospitals. *Waste Management*. 28. p 1236–1245.
- Rao, L., Ranyal, W., Bhatia, L., and Sharma, L. (2004). Biomedical Waste Management: An Infrastructural Survey of Hospitals. *MJAFI*. 60. p 379- 382.
- Tudor, T.L., Noonan, C.L., and Jenkin, L.E.T. (2005). Health care waste management: a case study from the National Health Service in Cornwall, United Kingdom. *Waste Management*. 25 (6). p 606–615.
- World Health Organization (WHO). (2005). *Healthcare waste management*. World Health Organization. Retrieved from www.healthcarewaste.org on (26. Feb. 2009).